Goddard Space Flight Center

Lightning & Severe Weather Safety Brief

Supervisor's Training Guide

“Lightning & Severe Weather Protection” Supervisor’s Training Guide

Note to Supervisor

All information that you cover in your training points comes from the included safety brief. It covers NASA/Goddard specific policies. It can also include historical and technical facts about the topic covered.

Supervisors Training Points:

***Note**:* All topics provided within this safety brief are intended for you to cover with your employee’s. This package is designed as a training guide to assist all levels of supervisors. If you feel more comfortable using your own words, please do so.

1. Provide one copy of Lightning & Severe Weather Protection Brief to each employee.

2. Your Supervisor’s Training Guide Package contains a sign-in sheet.

State,

- “Everyone needs to fill out the information on the sign-in sheet.”
- “List the code you belong to.”
- “Print your name. Fill out the rest of the information.”
- “Place your signature in the space provided.”

Tell the group to,

- “Take a couple of minutes to glance over the training material as the sign-in sheet is being passed around.”

3. After a couple of minutes, announce the topic to be covered this Month, · “As you can see, this months training topic is titled “Lightning & Severe Weather Protection.”

4. Proceed to cover the information contained within the Supervisor’s Training Guide, including the following:

Thunderstorm (Severe Weather) Facts.
What Makes a thunderstorm?
Lifecycle of a thunderstorm.
When are thunderstorms most likely?
Who’s most at risk from thunderstorms?
What is Lightning?
Ways lightning can kill.
Protection during lightning storms.
Lightning caused hazards.
First aid for lightning victims.
Lightning accident & incident statistics.
Which way does lightning travel?
Lightning: Myths & Facts
Environmental Clues.
Stay informed about the storm.
Personal Lightning Safety (Handout).

LIGHTNING & SEVERE WEATHER PROTECTION

Thunderstorm (Severe Weather) Facts

Thunderstorms affect relatively small areas when compared with hurricanes and winter storms. The typical thunderstorm is 15 miles in diameter and lasts an average of 30 minutes. Nearly 1,800 thunderstorms are occurring at any moment around the world. That's 16 million a year!

Despite their small size, all thunderstorms are dangerous. Every thunderstorm produces lightning, which kills more people each year than tornadoes. Heavy rain from thunderstorms can lead to flash flooding. Strong winds, hail, and tornadoes are also dangers associated with some thunderstorms.

Of the estimated 100,000 thunderstorms that occur each year in the United States, only about 10 %, or 10,000, are classified as severe.

The National Weather Service considers a thunderstorm severe if it produces hail at least 3/4-inch in diameter, wind 58 mph or higher, or tornadoes.

Take the time NOW to understand these dangers and learn basic safety rules!

Flash Floods/Floods

The number ONE thunderstorm killer...nearly 140 fatalities each year. Most flash flood deaths occur at night and when people become trapped in automobiles.

Lightning

Occurs with ALL thunderstorms. Averages 93 deaths and 300 injuries each year. Causes several hundred million dollars in damage to property and forests annually.

Straight-line Winds

Responsible for most thunderstorm wind damage. Winds can exceed 100 mph! One type of straight-line wind, the downburst, can cause damage equivalent to a strong tornado and can be extremely dangerous to aviation.

Large Hail

Causes nearly $1 billion in damage to property and crops annually. Costliest United States hailstorm: Denver, Colorado, July 11, 1990. Total damage was $625 million.

Tornadoes

Nature's most violent storms. Winds can exceed 200 mph. Result in an average of 80 deaths and 1,500 injuries each year. Most fatalities occur when people do not leave mobile homes and automobiles.

What makes a thunderstorm?

Every Thunderstorm Needs:

- Moisture - to form clouds and rain.
- Unstable Air - relatively warm air that can rise rapidly.
- Lift - fronts, sea breezes, and mountains are capable of lifting air to help form thunderstorms.

Life Cycle of a Thunderstorm

Developing Stage

- Towering cumulus cloud indicates rising air.
- Usually little if any rain during this stage.
- Lasts about 10 minutes.
- Occasional lightning during this stage.

Mature Stage

- Most likely time for hail, heavy rain, frequent lightning, strong winds, and tornadoes.
- Storm occasionally has a black or dark green appearance.
- Lasts an average of 10 to 20 minutes but may last much longer in some storms.

Dissipating Stage

- Rainfall decreases in intensity.
- Some thunderstorms produce a burst of strong winds during this stage.
- Lightning remains a danger during this stage.

When are thunderstorms most likely?

Thunderstorms are most likely to happen in the spring and summer months and during the afternoon and evening hours but can occur year-round and at all hours.

Who's Most At Risk From Thunderstorms?

From Lightning:

People who are: outdoors, especially under or near tall trees; in or on water; or on or near hilltops.

From Flooding:

People who are in automobiles when flash flooding occurs near them.

From Tornadoes:

People who are in mobile homes and automobiles.

What is Lightning?

The action of rising and descending air within a thunderstorm separates positive and negative charges. Water and ice particles also affect the distribution of electrical charge.

Lightning results from the buildup and discharge of electrical energy between positively and negatively charged areas. The average flash could light a 100-watt light bulb for more than 3 months.

Most lightning occurs within the cloud or between the cloud and ground. Your chances of being struck by lightning are estimated to be 1 in 600,000 but could be reduced by following safety rules.

Most lightning deaths and injuries occur when people are caught outdoors. Most lightning casualties occur in the summer months and during the afternoon and early evening.

The air near a lightning strike is heated to 50,000 degrees F hotter than the surface of the sun! The rapid heating and cooling of air near the lightning channel causes a shock wave that results in thunder.

Lightning Safety

Thunderstorms and lightning are most likely to develop on hot, humid days. Thunderstorms and lightning can be very dangerous, especially if a person is outdoors without proper protection. If lightning is seen or heard, take protective action immediately.

Lightning Safety

- Avoid tall, isolated objects during a lightning storm.
- Let professionals handle fallen wires.

Ways Lightning Can Kill

There are five ways in which lightning can severely injure or kill people or animals.

1. A direct strike usually results in cardiac arrest and/or stoppage of breathing.
2. A side flash may occur when the body of a person provides an alternate or parallel path for the current. This means the person may be another way for the current to reach the ground. If the current passes through the head or heart, death may result.
3. Conducted current from a lightning flash may range from tingling shock to a massive current diverted from a poorly grounded electric power pole through the wiring system.
4. Step voltage radiates out through the ground from a struck tree or pole. This results in many livestock deaths every year.
5. Fires, fallen trees, crushed cars. These are secondary effects. Injuries that occur from these are an indirect result of lightning.

Protection During Lightning Storms

There are several things one can do if caught outdoors when a lightning storm strikes. Take shelter inside a building or car and close the windows and doors. Avoid elevated locations on center such as roof tops. Get off farm machinery. Get out of the water if you are swimming or boating, and get away from it. If boating, stay low and avoid contact with the water.

Do not take refuge under any tall, isolated object, such as a tent or tree. Standing under a group of trees, shorter than others in the area, is better than being in the open. Avoid electrical fences, clothes lines, metal pipes, rails, telephone poles and other conductors. Put down any object that might conduct electricity, such as a rake, hoe or shovel. Seek low ground, preferably a ditch or gully. If you are outside with no protection, get to a low spot. Make your body low to the ground, but <u>do not</u> lie flat on the earth. Curl on your side or drop to your knees and bend forward, putting your hands on your knees. If there is a group of people, spread out. If someone feels their hair stand on end, it may mean lightning is about to strike. Stay calm and keep low. This will help reduce your chances of being struck by lightning.

If lightning strikes are suspected, keep clear of windows if inside a dwelling. Turn off the television and any other electrical appliances. Electricians suggest unplugging televisions and other valuable appliances because lightning can strike or cause electrical surges that can destroy these appliances. Postpone baths, showers and doing dishes until the storm passes because there is the possibility of electrocution. Stay away from water and gas pipes (plumbing), electrical appliances and telephones because electricity can travel through these and cause electrocution.

Lightning-Caused Hazards

Fallen Wires: Do not touch fallen wires. Report them to the police or local utility immediately. If on center Dial 112 (Greenbelt) or 1333 (Wallops). If the wire should fall on an occupied vehicle, tell the driver to stay in it and drive away, if possible. If they are unable to drive away, tell them to wait for help and do not get out. They are safe inside the car, but should avoid touching the metal parts of the car.

Electrical Fires: If an appliance or tool catches fire, try to unplug it or turn off the current at the fuse box. Do not pour water on the fire. Use a Class C fire extinguisher or throw baking soda on the fire. If it gets out of control, Dial 112 (Greenbelt) or 1333 (Wallops) and get out.

First Aid for Lightning Victims

Make sure all lightning victims have a medical examination even if they do not seem to need it.

Besides burns, lightning can also cause nervous system damage, broken bones and loss of hearing or eyesight. Victims may experience confusion and memory loss. First aid for lightning victims needs to be carried out immediately. After the lightning strikes, get to the victim as quickly as possible. Check breathing and pulse if the victim is unconscious. If the victim has a pulse, but is not breathing, begin mouth-to-mouth resuscitation, if qualified. If there is no pulse, begin cardiopulmonary resuscitation (CPR), if qualified. Check for other injuries, such as possible fractures. Do not move a suspected spinal injury victim. Cover the electrical burn with a dry, sterile dressing, but do not cool the burn. There may be more than one burn area -- one where the current entered the body and another where it left. Dial 112 (Greenbelt) or 1333 (Wallops) for help. Keep the victim from getting chilled until help arrives.

If a person struck by lightning appears only stunned or otherwise unhurt, medical attention may still be needed. Check for burns, especially at fingers and toes, and areas next to buckles and jewelry. Make sure all lightning victims have a medical examination even if they do not seem to need it.

LIGHTNING ACCIDENT AND INCIDENT STATISTICS

35 YEARS OF LIGHTNING DEATHS & INJURIES

In October 1997, the National Oceanic and Atmospheric Administration published findings of some 35 years of USA lightning statistics. Fatalities, injuries, and damage were compiled for the years 1959-1994. Results of collected statistical data are as follows:

1. Location of Incident:

   40% Unreported.
   27% Open fields & recreation areas (not golf).
   14% Under trees (not golf).
   8% Water-related (boating, fishing, swimming…).
   5% Golf/golf under trees.
   3% Heavy equipment and machinery-related.
   2.4% Telephone-related.
   0.7% Radio, transmitter & antenna-related.

2. Gender of victims = 84% male; 16% female.
3. Months of most incidents = June 21%, July 30%, Aug 22%.
4. Days of week of most incidents = Sun./Wed./Sat.
5. Time of day of most incidents = 2 PM to 6 PM.
6. Number of victims = One (91%), two or more (9%).
7. Deaths by State, Top Five = FL, MI, TX, NY, TN.
8. Injuries by State, Top Five = FL, MI, PA, NC, NY.

NUMBER OF DEATHS BY NATURAL HAZARDS, 1940-1981

(after Kessler, 1988)	
LIGHTNING	7,741
TORNADO	5,268
FLOOD	4,481
HURRICANE	1,923

In recent years, people have been killed by lightning while:

- boating
- standing under a tree
- playing soccer
- swimming
- riding on a lawnmower
- fishing in a boat
- golfing
- talking on the telephone
- mountain climbing
- bike riding
- loading a truck

Which way does lightning travel?

A cloud-to-ground lightning strike begins as an invisible channel of electrically charged air moving from the cloud toward the ground. When one channel nears an object on the ground, a powerful surge of electricity from the ground moves upward to the cloud and produces the visible lightning strike!

Lightning Myths and Facts

Myth	Fact
If it is not raining, then there is no danger from lightning.	Lightning often strikes outside of heavy rain and may occur as far as 10 miles away from any rainfall.
The rubber soles of shoes or rubber tires on a car will protect you from being struck by lightning.	Rubber-soled shoes and rubber tires provide NO protection from lightning. However, the steel frame of a hard-topped vehicle provides increased protection if you are not touching metal. Although you may be injured if lightning strikes your car, you are much safer inside a vehicle than outside.
People struck by lightning carry an electrical charge and should not be touched.	Lightning-strike victims carry no electrical charge and should be attended to immediately.
"Heat lightning" occurs after very hot summer days and poses no threat.	What is referred to as "heat lightning" is actually lightning from a thunderstorm too far away for thunder to be heard. However, the storm may be moving in your direction!

Environmental Clues:

When skies darken or thunderstorms are forecast, look AND listen for:

- Increasing wind.
- Flashes of lightning.
- Sound of thunder.
- Static on your AM radio.

To estimate the distance <u>in miles</u> between you and the lightning flash, count the seconds between the lightning and the thunder and divide by five.

STAY INFORMED ABOUT THE STORM…

by listening to NOAA Weather Radio, commercial radio, and television for the latest severe thunderstorm WATCHES and WARNINGS.

When conditions are favorable for severe weather to develop, a severe thunderstorm WATCH is issued.

Weather Service personnel use information from weather radar, satellite, lightning detection, spotters, and other sources to issue severe thunderstorm WARNINGS for areas where severe weather is imminent.

Severe thunderstorm warnings are passed to local radio and television stations and are broadcast over local NOAA Weather Radio stations serving the warned areas. These warnings are also relayed to local emergency management and public safety officials who can activate local warning systems to alert communities.

What to Listen For...

SEVERE THUNDERSTORM WATCH: tells you when and where severe thunderstorms are more likely to occur. Watch the sky and stay tuned to know when warnings are issued. Watches are intended to heighten public awareness and should not be confused with warnings.

SEVERE THUNDERSTORM WARNING: issued when severe weather has been reported by spotters or indicated by radar. Warnings indicate imminent danger to life and property to those in the path of the storm. Also listen for Tornado Watch or Warning and Flash Flood Watch or Warning. Also listen for Tornado Watch or Warning and Flash Flood Watch or Warning.

PERSONAL LIGHTNING SAFETY

(Please Reproduce and Distribute to Each Employee)

When you first see lightning or hear thunder, suspend activities and seek shelter. A metal vehicle or a substantial building is a safe place. Wait until 30 minutes after the last observed lightning or thunder before resuming activities.

"If you can see it (lightning), flee it (take shelter)."
"If you can hear it (thunder), clear it (suspend activities)."

PERSONAL LIGHTNING SAFETY TIPS

1. *PLAN in advance your evacuation and safety measures.* When you first see lightning or hear thunder, activate your emergency plan. Now is the time to go to a building or a vehicle. Lightning often precedes rain, so don't wait for the rain to begin before suspending activities.

2. *IF OUTDOORS...Avoid water. Avoid the high ground. Avoid open spaces.* Avoid all metal objects including electric wires, fences, machinery, motors, power tools, etc. Unsafe places include underneath canopies, small picnic or rain shelters, or near trees. Where possible, find shelter in a substantial building or in a fully enclosed metal vehicle such as a car, truck or a van with the windows completely shut. If lightning is striking nearby when you are outside, you should:

   A. Crouch down. Put feet together. Place hands over ears to minimize hearing damage from thunder.

   B. Avoid proximity (minimum of 15 ft.) to other people.

3. *IF INDOORS... Avoid water. Stay away from doors and windows. Do not use the telephone. Take off head sets.* Turn off, unplug, and stay away from appliances, plumbing, computers, power tools, & TV sets. Lightning may strike exterior electric and phone lines, inducing shocks to inside equipment.

4. *SUSPEND ACTIVITIES for 30 minutes after the last observed lightning or thunder.*

5. *INJURED PERSONS do not carry an electrical charge and can be handled safely.* Apply First Aid procedures to a lightning victim if you are qualified to do so. Dial 112 at Greenbelt or 1333 at Wallops or send for help immediately.